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U. S. DEPARTMENT OF AGRICULTURE.
OFFICE OF EXPERIMENT STATIONS—FARMERS INSTITUTE LECTURE NO. 4.
A. C. TRUE, Director.

SYLLABUS OF ILLUSTRATED LECTURE

ON

PROFITABLE CATTLE FEEDING.

BY

FREDERICK B. MUMFORD, M. S.,
Professor of Animal Husbandry, University of Missouri.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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PREFATORY NOTE.

This syllabus of a lecture upon Profitable Cattle Feeding, by Frederick B. Mumford, M. S., Professor of Animal Husbandry, University of Missouri, and Acting Director of the Missouri Agricultural Experiment Station, Columbia, Mo., is accompanied by 45 views illustrating this topic. The syllabus and views have been prepared for the purpose of aiding farmers' institute lecturers in their presentation of this subject before institute audiences.

The numbers in the margins of the pages of the syllabus refer to similar numbers on the lantern slides and to their legends as given in the Appendix; those in the body of the text refer to corresponding numbers in the list of authorities and references, page 20.

In order that those using the lecture may have opportunity to fully acquaint themselves with the subject, references to its recent literature are given in the Appendix.

JOHN HAMILTON,
Farmers' Institute Specialist.

Recommended for publication.
A. C. TRUE, *Director.*

Publication authorized.
JAMES WILSON, *Secretary of Agriculture.*

WASHINGTON, D. C., *April 15, 1905.*

PROFITABLE CATTLE FEEDING.

By Frederick B. Mumford, M. S.

FACTORS WHICH DETERMINE PROFIT.

View.

The most important factors which determine profit from cattle-feeding operations are:

I. Conformation or type.
II. Quality.
III. Breeding.
IV. Age.
V. Feeding methods.

CONFORMATION OR TYPE OF ANIMAL.

By the conformation or type is meant the form and inherited tendencies of the animal which make him peculiarly adapted for the production of a certain animal product. The most approved type of beef animal is one that can produce the largest amount of valuable beef from the smallest consumption of food. In trying to determine the most profitable type of animal for beef production, it will first be necessary for us to consider the finished product. What are the demands of the market? What kind and quality of beef brings the highest price?

Cuts of Beef.—The accompanying diagram illustrates clearly 1
the most approved method of cutting up a beef carcass, giving the amounts, the names, and the prices received for the various butcher's cuts. This diagram illustrates the carcass of a well-fattened grade steer weighing 1,200 pounds alive or 800 pounds dressed weight. Of this, 708 pounds is marketable meat. A careful study of this illustration will show that the high-priced cuts are taken from the ribs, loin, and hind quarters. These valuable cuts together weigh 346 pounds, and at Chicago prices in 1896 would retail for $44.55. The cheaper cuts from the fore quarters, belly, and flank weigh 362 pounds and would retail for only $16.48. It is apparent from a study of this diagram that the high-priced and valuable cuts are all found on the back

View.

and loin of the animal. It naturally follows that an animal having a broad, thick-fleshed back and loin will have a relatively high proportion of these costly meat cuts. A pound of porterhouse may sell for 20 cents, while a pound of ribs-plate brings only 4 cents. Thus, when a load of fat cattle are shipped to market, the buyer examines them always with a view to the amount of porterhouse, sirloin, and prime of rib butcher's cuts that can be secured. The cheaper cuts sell for less than the buyer pays live weight for the animal. The profit comes chiefly from the advanced price on the better cuts. Fifty pounds difference in the weight of an animal, if that difference is due to the increased weight of the porterhouse, sirloin, and prime of rib, may make a difference of $8 to $10 in the live-weight value of the animal. On the other hand, 50 pounds difference in the weight of an animal, if that difference is due to an increased development of ribs-plate or other cheap cuts, may make a difference of only $2 in the live-weight value of the animal.

2 View No. 2 shows the method of cutting up beef for wholesale. The prices are also indicated.

View No. 3 gives the location and names of the several parts of a beef animal.

3 General Form of the Feeder.—A good feeder has a strong back and a straight top line. The underline should also be approximately straight, and especially should it be carried back by a low flank. In judging this point in a lean animal we should give due credit to a deep, expanded paunch, which is indicative of great capacity. Above all things in connection with straight, uniform, and parallel lines, a deep and broad frame giving the general appearance of a low set and blocky form should be insisted upon. This type is particularly valu-
4 able in producing baby beef, but care should be taken not to overestimate this characteristic. Extreme pony-built animals
5 as well as rangy ones should be avoided. A certain elasticity of movement and vigor of action, giving the animal a stylish appearance, is a valuable character.[1][a] Coarseness and lack of smoothness indicate inferior feeding qualities.[2]

QUALITY IN BEEF CATTLE.

6 An animal possessing a coat of fine, bright, silky hair; a loose, pliable skin of medium thickness, and a fine, dense, smooth bone is said to possess "quality." These characteristics are invariably
7 associated with early maturity and rapid fattening. The possession of these valuable qualities does not necessarily imply

[a] Numbers refer to references on page 20.

greater gains on the same food, but it does imply that an animal of good quality can be finished earlier, and consequently on less food than would be required for animals that are covered with a hard, papery skin which clings tightly to the carcass and that are distinguished by coarse, large heads, large bone, and a general lack of harmony in the development of parts.

IMPORTANCE OF EARLY MATURITY.—How important the quality of early maturity is in practical feeding operations may be seen from a study of the experiments which have been made on the subject. In this connection, however, it must always be remembered that early maturity means both that an animal may be finished at a comparatively young age, and also that at any given period of development he may be satisfactorily fattened during a shorter feeding period, and therefore with a smaller absolute amount of food. The shorter the feeding period, if the cattle are receiving a full feed of grain, the less food will be required to produce a pound of gain. This is clearly shown by the following table:[3]

Cost of gain in feeding periods of different lengths.

Period.	Grain feed required for 100 pounds gain.	Increase of feed required.
	Pounds.	*Per cent.*
56 days	730	.....
84 days	807	10
112 days	840	15
140 days	901	23.
168 days	927	27
182 days	1,000	37

It will be seen from this table that it requires 37 per cent more grain to produce a pound of gain at the close of the feeding period than at the beginning. In other words, if these animals could have been finished in three months instead of six months the resulting profit would have been largely increased.

QUALITY IN THE FAT ANIMAL.—While quality in fat animals is indicated in general by the same features that characterize feeders, we are in addition called upon to take account of the actual composition of the flesh itself. Excessive fatness is not necessarily an indication of high quality in a fat animal. The qualities most desired in a finished animal are a carcass that possesses a small percentage of offal or waste parts and a high percentage of edible meat. Of this edible portion there should be an especially large development of the porterhouse, sirloin, and prime of rib cuts. High quality also demands that the flesh

View.

when exposed for sale shall exhibit a well-marbled appearance, resulting from alternate layers of fat and lean, and in particular that there be a good distribution of fat intermingled with the muscular fibers. Such meat possesses a flavor, tenderness, and juiciness that commends it to the most exacting palate.

The process of fattening an animal develops and improves all of the foregoing desirable characteristics. A fat animal dresses a much higher percentage of edible beef and a less percentage
13 of offal or waste. Such an animal also furnishes a better flavored, more tender and juicy flesh than a lean one. Animals are fattened, therefore, to improve their quality.

The above considerations have primarily to do with the dressed carcass. But we are from necessity compelled to determine by an examination of the living animal whether or not the particular individual before us possesses qualities most desirable on the butcher's block.

14 What are the indications of prime quality in the finished fat steer? "Desirable quality in flesh is indicated by a firm, yet mellow and springy consistency of the flesh at the crops, along the back, at the loins, and even on the side, beneath the gentle pressure of the outstretched hand."[2] Undesirable quality, on the other hand, is indicated by a large head, coarse bone, unevenly distributed and patchy flesh, particularly about the base of the tail, where in over-fat steers or those of inferior quality we frequently see bunches or rolls of fat.

It might be inferred from what has been stated that the feeding or fattening process is altogether responsible for the quality, but above and beyond the influence of feeding stands the influence of the individual and his inherited tendencies.[2]

BREEDING.

High Quality from Good Breeding.—No proposition in the whole realm of live stock husbandry has been more definitely
15 demonstrated than that well-bred animals are of better quality than poorly-bred and can be fed more profitably. There are
16 horses that can eat a bushel of oats and in some way extract energy therefrom sufficient to trot a mile in two minutes.
17 There are other horses that may consume the same amount of food and may even have the advantage of the same training, but can never succeed in extracting more than enough energy to trot the same mile in five minutes. There are cows that when fed a certain amount of food will easily produce 200 pounds of butter in one year, while there are others that will produce only 100 pounds of butter annually, although fed exactly the same food in kind, quality, and amount.

View.

It is as true also that among beef cattle some are capable of consuming a certain definite amount of food and producing therefrom a fine quality of flesh which sells readily for 6 cents live weight, while other cattle fed on the same food under the same conditions sell slowly at 4 cents per pound. This great difference is not due primarily to the feeding, but to the breeding of the animal.

At the Iowa Experiment Station cattle of various breeds were fed for nine months.[1] The gains made were approximately the same and the food required to produce a given gain was about equal with all breeds. But when these cattle were offered for sale in the Chicago yards the strictly beef-bred animals brought $2.22½ per hundred more than others not specifically bred for 18
their beef qualities. The Shorthorn, Aberdeen Angus, and Hereford steers easily brought the highest price of the day, while the Jerseys and Holsteins were sold for scarcely enough to pay for their feeding and shipping. Director Curtiss says: "The Jersey took on flesh rapidly, and was exceedingly fat 19
and well finished. He was as good as it was possible to make a Jersey steer, yet when he went to market he had to sell $2.12½ below top quotations, while the Hereford was one of a carload to sell 10 cents above the top for any other cattle on the market."

In the report of a very carefully conducted block test at the Missouri Station,[4] some data are published from which the following table is deduced, showing the development of the high-priced cuts in the pure-bred Shorthorn, Hereford, and Aberdeen Angus steers, as compared with scrubs:[14]

Table showing that heaviest high-priced cuts are found on beef-bred animals. 20

Breed.	Weight of all cuts.	Weight of porterhouse and sirloin.	Percentage of porterhouse and sirloin to total.
	Pounds.	*Pounds.*	*Per cent.*
Shorthorn	1,046	127	12.1
Hereford	1,007	109	10.7
Angus	980	109	11.1
Scrub	824	82	9.1

It is shown in the above table that a wide difference in the percentage of highly valuable meat may exist between beef-bred and scrub or native cattle. But scrub as used here does not mean inferiority in general health, condition, or ability to gain well on a given amount of feed. The term "scrub" in this bulletin was used merely to designate an animal of no special

View.

breeding as opposed to those of the beef breeds. As a matter of fact, in the experiment here quoted, the scrub was preeminently the most thrifty and made better gains than some of the pure-bred steers. This only emphasizes again the incontrovertible fact that mere ability to eat well and gain well does not accurately measure a steer's value as a profitable feeder. The main thing is to feed animals of the right type, and thus place on the market a product of greater value.

The results of carefully conducted experiments, the experience of the practical feeder and of the great packing houses, and the final and decisive test of the butcher's block all agree in pronouncing the well-bred animal the most profitable one. And these well-bred beef animals are most profitable because they fulfill the requirements as to conformation.[7]

We hear it frequently stated that pure-bred animals are more profitable because they are able to produce more gain from a given amount of food. This statement can not be substantiated.
21 The experiments all point to the fact that the well-bred animals are more profitable because, as shown above, they produce a much more valuable product, and not because they are able to produce a greater bulk on the same amount of food.

22 View 22 represents a good type for profitable feeding. This is from a photograph of a steer fattened at the Missouri Experiment Station, taken April 1, 1902. The steer was at that time 23 months old and during the winter from December 24, 1901, had received only 6 pounds of corn daily and 17 pounds of cowpea hay. He had gained an average of 1.3 pounds per day for the period named. Notice particularly the uniform, straight lines; the short neck and generally thick-set appearance. The back is broad and thick fleshed, and spring of the rib is exceptionally good. The legs are short and of medium fineness and the head is short and not lean.

23 View 23 represents the poorest feeder in a large herd in the experimental feed lots at the Missouri Station. This steer was of the same age as that shown in view 22. He had the same grain ration and cowpea hay and sorghum for roughage. He gained 1.1 pounds daily. Such a steer requires long feeding to properly finish. Notice the entire lack of straight, even, and uniform lines. The head is large, the neck long and thin, and the shoulders coarse. The legs are too long and the body too shallow. The rangy appearance of this animal is intensified by sharp hips and pin bones, rather long, narrow back, and flat ribs. His girth is very deficient and no part of him can be called thick fleshed. He had the same amount of corn daily

as the animal shown in view 22, and all the cowpea hay he could eat. A close comparison of these two views (22 and 23) will be very helpful to the student of animal types.

AGE.

Influence of Age on Cost of Gain.—In general the present practice is to place all classes of meat-producing animals on the market at a younger age than formerly. The time was when fat cattle were not considered mature or as furnishing the finest quality of beef until they were 4 or 5 years old. It is now no uncommon thing for beef animals to be placed on the market well finished at the age of 12 to 15 months. Hogs formerly were fed to a weight of 400 to 600 pounds, and 2 or 3 year old wethers filled the pens of the sheep feeders. Now, however, it is the common practice to finish young animals.

What influence has this change in market requirements had upon the business of the stock feeder? Undoubtedly it has been distinctly favorable to the profitable production of meat animals. No material fact in stock feeding has been more definitely demonstrated than that the cost of gain depends directly upon the age of the animal.[12] The younger the animal the less food is required to produce a pound of gain.

The following table, prepared from data obtained in experiments by the Central Experimental Farm of Canada[5] in feeding calves, yearlings, 2-year-olds, and 3-year-olds clearly indicates this fact:

Influence of age on cost of beef.

24

Age.	Daily gain.	Gain in 186 days.	Cost of 100 pounds gain.	Profit per steer.	Profit per 1,000 pounds, live weight.
	Pounds.	*Pounds.*			
3 years	1.65	307	$6.22	$16.53	$12.80
2 years	1.67	311	5.70	20.50	19.10
1 year	1.85	345	4.65	26.07	27.30
Calf	2.14	398	3.60	14.11	31.00

This table shows conclusively that the younger the animal the more rapid the increase in live weight. The calf requires less food than a yearling, and likewise a yearling less food than a 2-year-old, but a yearling gains more rapidly than a 2-year-old, and a 2-year-old gains more rapidly than a 3-year-old. Hence we are justified in the conclusion that young animals gain more economically than older ones.

25

A recalculation of these data, on the basis of an investment of $1,000 in the feeding of cattle of each kind, as in the table on the following page, makes the differences due to age more striking.

View
26 *Comparative profit from feeding young and older cattle (on the basis of $1,000 invested).*

Age.	Cost per 100 pounds.	Selling price per 100 pounds.	Profit per steer.	Profit per 1,000 pounds live weight.	Profit on $1,000 investment.
3-year old	$4.00	$5.00	$9.17	$7.10	$177.50
2-year old	4.00	5.00	8.53	7.95	198.75
1-year old	4.00	5.00	10.83	11.36	284.00
Calf	4.00	5.00	10.15	22.30	557.50

It will be seen from this table that when cattle are purchased at the same price per pound and sold on the same margin, the profit per 1,000 pounds live weight at the beginning is largely in favor of the young animal. It is equally true that the returns for each $1,000 invested is also largely in favor of the younger animal. It is not therefore surprising that the most intelligent feeders are now feeding expensive grains to young cattle. As long as the market requirements are satisfied by a live-weight carcass of 1,200 to 1,400 pounds, it will be profitable to push these animals from birth to the time they are sold on the market. It may be safely stated that an acre of corn will produce more beef when fed to young cattle than it will when fed to the older animals.

It does not necessarily follow from what has been presented that it will always be more profitable for the cattle feeder to
27 buy young cattle for fattening. Profit in cattle feeding is largely dependent upon the margin between the buying and the selling price. The greater this margin and the heavier the animals when purchased for feeding, the greater will be the ultimate profit. Under existing conditions there is a smaller margin on young cattle. Thin, 2-year-old steers weighing 900 pounds may frequently be purchased for 4 cents a pound and, after fattening, sell for $5.50 or $6 per hundred. Such cattle may be much more profitable for the feeder than calves or yearlings weighing 500 pounds, costing 4½ cents and selling when finished for 5½ cents per pound.

28 We must clearly distinguish, however, between raising one's own cattle to feed and buying them. Unquestionably when the feeder raises his own cattle, the earlier he can finish them, the more profitable will be the enterprise. The cattle feeder sometimes finds it more profitable, as shown above, to buy older cattle.

DETAILED DESCRIPTION OF A GOOD FEEDER.

View.

HEAD AND NECK.—The first step in judging an animal is to 29
examine carefully its general appearance, including a close scrutiny of the form and quality, then to turn attention to a detailed study of the head and neck. The head and shoulders should be moderately fine, with a broad, full, and high forehead, indicating a generous brain, which will suggest a well-developed nervous system and strong vitality. A short face, but not lean, is an ever-present characteristic in a beef steer of prime quality. A broad muzzle with nostrils wide and open is seldom associated with a poor feeder. A clear, full eye shows good health and a quiet temperament. Above all things, shun a steer with a small, contracted "pig" eye. The head should be well carried on a short, full, thick neck. It is here that the butcher and feeder are somewhat at odds, because the butcher looks upon the neck as so much beef of an inferior quality that must be sold at a reduced price; but the feeder long ago learned that a short, thick neck is invariably associated with thickness of flesh, and gives assurance of an animal's ability to lay up fat on the loin, back, and rib.

FOREQUARTER.—Passing back from the head and neck we observe next the shoulder vein, which, as indicated by the chart, lies just in front of the shoulder blade. This region should be characterized by fullness. The shoulder of a good beef steer is compact and well covered with flesh, with no tendency to coarseness or angularity. The condition of the animal at the time will, of course, materially influence this point and should be given due weight.

The chest, which includes that region of the trunk in which the vital organs, the heart and lungs, are found, is of the highest significance, as indicating the existence or nonexistence of qualities fundamental to the usefulness, gradual development, and final profit of the beef animal. A broad, deep, and full
chest is a very valuable characteristic. Such a chest is prima 30
facie evidence of large heart and lung room, and, other things being equal, of a good development of these supremely important organs. When we remember that the efficiency of the blood is directly dependent upon the respiratory power of the lungs, and that this blood is the chief agent in bringing about the assimilation of the large quantities of food consumed by the fattening animal, and that this life-giving fluid is pumped

View.

by the heart to the most remote extremities, we can see the necessity of a spacious chest. The forelegs may indicate quality. Sometimes, owing to the way they are placed under the body, they suggest a narrow chest. The desirable conformation is a straight leg, set firmly at the corners of the body, with a smooth, moderately fine, and dense shin or cannon bone. Coarse bones, big joints, and rough, scaly hoofs are objectionable.

Body.—The girth, or as it is sometimes called, the heart girth, is frequently so small as to be a very serious defect. A desirable beef animal has a large girth. A large girth is associated with many other fundamentally essential characters, such as full crops, well-filled foreflanks, well-sprung ribs, and a wide, deep chest. Since no amount of feeding can ever correct a marked deficiency in the girth of an animal, this is a highly important feature.

The importance of an arched, well-sprung rib is very often overlooked by those who place undue stress upon a straight underline. By an arched, well-sprung rib we mean a rib which leaves the backbone almost horizontally and carries the width of the back well out to the side, drooping with a graceful curve downward and outward and extending well down, making a
31 deep and capacious abdomen. An animal possessing such a rib will frequently show a somewhat pendant or disproportionately large paunch when in a lean condition, while the same animal fattened may possess an almost ideal bottom line. Although a pendant paunch is not in itself always desirable, when associated with a broad back and caused by a deep, well-sprung rib, it does become an important and desirable characteristic.

With the well-formed rib there should be a broad, straight back moderately short and well covered with flesh. Excessively long backs seem to be uniformly present in late-maturing animals. The loin, carrying as it does the very highest quality of flesh to be found in the animal, is justly regarded by feeders, butchers, and consumers alike as the one most important part of the entire animal. A good loin is broad, full, and thickly fleshed. Firm, thick flesh is especially to be desired, as it may happen that while an animal may possess a broad back it may be so sparsely covered with flesh as to make him an undesirable butcher's beast.

The flank that is low, thick, and full is always found with a straight underline and thick, deep quarters, and these are found with other desirable qualities in all good beef forms.

View. 32

HINDQUARTERS.—The hips are first to attract our attention in the hindquarters of an animal, and when these are wide apart, smooth, and well proportioned to the rest of the body, all the requirements for beef excellence are fulfilled. The rump of the good beef animal is long, level, wide, and entirely free from any suggestion of bunchy or patchy fat at the base of the tail. A long rump is considered by many practical breeders as a highly valuable quality.

The pin bones should be wide apart and sufficiently high to carry the back line out straight to the base of the tail. These bones should not be too prominent, and should be smooth and free from any indications of patchiness.

The tail, if terminated by a switch of fine hair and having moderately fine bone, may be a valuable indicator of good quality and early maturity, especially so when all other indications mentioned in the preceding paragraph point to the same conclusion. The tail must be well set on, neither too high nor too low. It should hang exactly at the angle of the body and hang straight down in a graceful manner.

The full, thick, and well-fleshed thigh will not be overlooked, and with such a thigh the twist will extend well down, giving the general appearance of very short legs when the animal is viewed from behind.

FEEDING.

The methods employed in fattening cattle will often determine the profit resulting. In general, all cattle feeding may be divided into—

1. Winter feeding.
2. Summer feeding.

WINTER FEEDING.—(a) It has been found profitable to feed a nitrogenous roughage, like clover, cowpea, or alfalfa hay with corn, to fattening steers.[20]

(b) Another method which is followed with great success in the middle West is to feed a limited corn ration (6 to 8 pounds) with some nitrogenous roughage like clover, cowpea, or alfalfa hay. On this ration animals frequently make a gain of 2 pounds per day throughout the feeding period. These cattle are usually finished on grass alone or a full ration of grain in addition to the pasture.

(c) When corn is worth 40 cents or more a bushel it has been found profitable to add some nitrogenous concentrate like cotton-seed or linseed meal.

View.

(d) Wherever silage has been used in cattle feeding it has been found to be considerably more efficient than the same material harvested in the ordinary way.

(e) Where a silo is not practicable the feeding of shock corn has given uniformly profitable results when fed to cattle.

33 Summer Feeding.—In sections where bluegrass or other natural pasture plants are obtained, it has been found profitable
34 to feed cattle a full ration of grain while on pasture. This method has in general proven more profitable at the Missouri Experiment Station than winter feeding. For two seasons there corn alone was fed in comparison with corn and cotton-
35 seed meal and corn and linseed meal. The best results, so far as the finish and quality of the fat cattle are concerned, were in every case secured from feeding corn and linseed meal. The ration composed of corn and cotton-seed meal invariably resulted in the largest gains per hundred pounds of feed fed. This ration was second to corn and linseed meal in point of finish and quality of the fat animals. The ration made up exclusively of shelled corn fed to cattle on pasture was sometimes the most profitable ration when corn was 40 cents or less per bushel.

Shelter and Profitable Gains.—The Missouri Experi-
36 ment Station, as the result of three years' trial, has shown that stabling cattle in warm barns is not only not essential but not profitable under the conditions prevailing there. Fattening cattle that received a heavy ration of concentrated grain did not need warm houses. Economical gains were invariably made at
37 this station when the cattle were loosely confined in a shed open to the south.

Grain Required to Produce 100 Pounds Gain.—The following table is interesting as indicating the amount of grain required to produce 100 pounds of gain. It will be seen that this quantity, and consequently the cost of 1 pound of gain, varies between wide limits.

Grain required for 100 pounds of gain for fattening cattle.

Kind of grain fed.	Age of cattle.	Length of feeding period.	Grain to produce 100 pounds gain.	Remarks.	Reference.
	Years.		*Pounds.*		
Corn meal	3	6 months	1,122	Roughage, corn stover.	Kansas Sta. Buls. 34, 60.
Ear corn	3	do	1,410	do	Do.
Dry shelled corn		5 months	1,105	do	Kansas Sta. Bul. 47.
Shelled corn soaked.		do	938	do	Do.
Corn-and-cob meal.		140 days	732	Steers in thin condition at beginning.	Kansas Sta. Rept., 1884.
Corn meal		do	795	do	Do.
Corn-and-cob meal.		150 days	1,260	Half fat at beginning.	Kansas Sta. Rept., 1885.
Corn meal		do	1,166	do	Do.
Ear corn	3	do	1,271		Kansas Sta. Buls. 34, 39, and 60.
Mixed grains		do	905		Do.
Cotton-seed meal	3	100 days	224	Roughage, cotton-seed hulls.	North Carolina Sta. Bul. 93.
Cotton seed meal	2	90 days	205	do	Arkansas Sta. Rept., 1890.
Mixed grains	2	92 days	790	Nine breeds	Iowa Sta. Bul. 20.
Do	2	6 months	956	Angus and Shorthorn.	Iowa Sta. Bul. 28.
Do	1	1 year	549	Six breeds	Michigan Bul. 44.
Do	2	do	879	do	Do.
Do	1	18 months.	560	Five breeds	Michigan Bul. 69.
Do	1	do	685	Four breeds	
Corn	2	119 days	1,151	Roughage, timothy hay.	Missouri (Board of Agr. Rept., Sept., 1901).
Do	2	do	831	Roughage, cowpea hay.	Do.
Do	1	80 days	[a] 605	Roughage, timothy hay.	Do.
Do	1	do	[a] 301	Roughage, clover hay.	Do.
Do	1	do	[a] 1,160	Roughage, sorghum hay.	Do.
Do	1	do	[a] 445	Roughage, clover and corn stover, equal parts.	Do.

[a] Each steer received only 6 pounds of corn daily.

The factors which are most important in determining the gain as shown in the table are the age, condition, methods of feeding, kind of roughage, and character of the grain ration. In this table no estimate has been made for the gains of hogs following the steers. The experiments so far conducted seem to indicate that the droppings of steers fed on corn meal or other finely ground meal contain a comparatively small amount of nutriment available for the hogs. On the other hand, whenever cattle are fed on ear corn, shelled corn, or Kafir corn the droppings are very valuable for hogs.

It may be safely stated, on the basis of the results already secured, that under conditions which require 1,000 pounds of unground corn to produce 100 pounds of gain on cattle we may estimate that 175 to 200 pounds of corn passes the steer undigested, and this is nearly all available for hogs. In other words, 1,000 pounds of corn will produce 100 pounds of beef and 40 pounds of pork.

View.

Stated in another way, 800 pounds of corn will produce 100 pounds of beef, and 175 to 200 pounds of corn in the droppings will make on the average about 40 pounds of pork. Estimated in still other terms, we are justified in saying that 100 pounds of shelled corn fed to steers will produce 4 pounds of pork on the hogs following. These estimates are very conservative and many feeders claim to secure much more gains from hogs than these experiments show.

The cheapest gains are apparently made on young steers while grazing, but at the Missouri Experiment Station results as favorable were secured while feeding yearlings a partial grain ration with clover hay. The costliest gains are those made from feeding 3-year-old steers in half fat condition at the beginning of the feeding period on an unbalanced ration of corn and timothy hay.

APPENDIX.

LANTERN SLIDES.

No. of view.

1. Carcass of a well-fattened grade steer as cut up by Chicago butchers, giving retail price per pound for the different cuts.

   A good 1,200-pound steer dresses about 800 pounds, and of this 708 pounds is marketable meat. Notice that the best cuts are taken from ribs, loin, and hindquarters. These valuable cuts together weigh 346 pounds and sell for $41.55. The less valuable cuts from the forequarters, belly, and flank weigh 362 pounds and bring only $16.48.

   From diagram prepared by F. B. Mumford from data furnished by E. F. Swift and S. T. White, of Chicago.

2. Side of beef showing how packers cut up beef for the wholesale trade.
   From U. S. Dept. Agr., Farmers' Bul. 71.

3. Names and location of the different parts of beef animal.
   Original.

4. A low, blocky type.

   This type matures quickly and sells for a high price.

   Original.

5. An ideal beef type.
   Courtesy of C. G. Comstock, Albany, Mo.

6. ~~Champion Angus heifer—Smithfield (England) Fat Stock Show.~~
   ~~From U. S. Dept. Agr., Farmers' Bul. 71.~~

   Pride of Silesia
   First prize + Champion Angus ox Show at 1913 Highland

7. Particularly good type of a profitable feeder.

   This steer weighed 1,650 pounds at 30 months old.

   Courtesy Missouri Experiment Station.

8. An unprofitable feeder.

   Legs too long, back too sharp, lines not straight and thinly covered with flesh.

   Courtesy Missouri Experiment Station.

9. A late maturing type.

   Will make good gains and if fed for a long time will bring a good price, but not so profitable as earlier maturing animals.

   Courtesy Missouri Experiment Station.

10. A medium steer.

    Would be better if lower in the flank and deeper and broader in conformation.

    Courtesy Missouri Experiment Station.

11. Table showing cost of gain is greater in long feeding periods.
    From Henry's "Feeds and Feeding."

12. Prime of rib beef cuts.

    On the right an excessively fat carcass. On the left a well-fattened carcass.

    Courtesy Missouri Agricultural College.

No. of view.

13. Loin cuts.
On the right an excessively fat carcass. On the left a well-fattened carcass.
Courtesy Missouri Agricultural College.

14. Challenger.
Grand champion steer International Show 1903. Weight 1,755 pounds. Sold for $26 per hundredweight.
Courtesy University of Nebraska.

15. ~~A Shorthorn bull—Hampton's Best.~~
~~Courtesy C. D. Bellows, Marysville, Mo.~~

16. Texas cattle in 1896.
From Illinois Sta. Bul. 78.

17. Texas cattle in 1901, showing five years' improvement resulting from use of pure-bred sires.
From Illinois Sta. Bul. 78.

18. ~~Shorthorn steer fed at Iowa Experiment Station.~~
~~Sold for $2.12½ per hundredweight more than No. 19.~~
~~From U. S. Dept. Agr., Farmers' Bul. 71.~~

19. An inferior type of beef animal.
Sold for $2.12½ per hundredweight less than No. 18.
From U. S. Dept. Agr., Farmers' Bul. 71.

20. Table showing that heaviest high-priced cuts are found on beef-bred animals.
Adapted from Missouri Sta. Bul. 24.

21. Ready for market.
Prize fat cattle at International Show, 1902. Fed by Turner McBaine, Columbia, Mo.

22. A profitable type for feeding.
Courtesy Missouri Experiment Station.

23. An unprofitable type.
Courtesy Missouri Experiment Station.

24. Yearling cattle on full feed in bluegrass pasture, at the Missouri Experiment Station.

25. Table showing influence of age on cost of beef production.
Adapted from Canada Cent. Expt. Farm Rpt. 1903.

26. Table showing comparative profit from feeding young and older cattle.
Adapted from Canada Cent. Expt. Farm Rpt. 1903.

27. A typical Western cattle-feeding scene.
Two-year-old cattle on full feed.
Courtesy J. T. and A. P. Johnson, Mexico, Mo.

28. Yearling cattle fed on corn and linseed meal and bluegrass pasture.
Missouri Experiment Station.

29. A good head and forequarter.
Courtesy C. G. Comstock.

30. Shorthorn bull—Invincible. A profitable type of beef cattle.
Courtesy T. J. Wornall & Son, Liberty, Mo.

31. A useful feeder, deficient in breadth and depth but good quality.
Courtesy Missouri Experiment Station.

32. A good hindquarter.
Courtesy C. G. Comstock.

No. of view.

33. A productive bluegrass pasture on farm Missouri Agricultural College.

34. Summer feeding.
Courtesy Missouri Louisiana Purchase Exposition Commission.

35. Summer feeding.
An ideal pasture scene. A part of these cattle sold for 8 cents per pound.
Courtesy Missouri Experiment Station.

36. The most profitable shelter yet devised for sheltering fat cattle.
On the farm of the Missouri Agricultural College.

37. Winter feeding without shelter.
Courtesy Missouri Experiment Station.

38. Shorthorn matrons.
Courtesy T. J. Wornall, Liberty, Mo.

39. Hereford breeding herd.
Courtesy Gudgell & Simpson, Independence, Mo.

40. First prize aged herd.
Missouri State Fair, 1903. Owned by O. Harris, Harris, Mo.

41. Hereford bulls.
The descendants of one of these bulls have sold for $25,000.

42. Pure-bred Herefords in pasture.
Courtesy T. C. Sawyer, Lexington, Mo.

43. The winning young herd of Shorthorns, 1903.
Courtesy George Bothwell.

44. High-class beef makers.
Aberdeen Angus cattle. Owned by W. J. Turpin, Carrollton, Mo.

45. Students judging fat cattle at the Missouri Agricultural College.

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Beef Cattle Score Card.[a]

Class, ——— Fat Steers.

GENERAL CHARACTERS.

Form.—Compact, thick-set, short-legged, and stocky in appearance; body deep, thick, and of medium length; top line straight; under line low in flanks; belly not unduly large; scale large for the age.

Quality.—General refinement and symmetry of clean-cut features; beef-breed character pronounced; bone fine and clean; hair fine and soft; skin fine; head, neck, and legs short.

Condition.—Prime; a deep, even covering of firm, mellow, and springy flesh, without ties, lumps, patches, or rolls, especially in back and loin; full in flanks, shoulder vein, and at base of tongue; top and points of shoulder, hip bones, and tail head smoothly covered; skin loose and soft; purse full.

Constitution.—Should be thoroughly healthy.

Early maturity.—General refinement and compactness; body large; extremities small; shortness of head, neck, and legs; amplitude of girth in chest, belly, and flanks.

Scale of points.	Perfect.	Score.
1. *Age*, estimated ..... corrected		
2. *Weight*, estimated ..... lbs; corrected ..... lbs.: Score according to age and condition	5	.....
3. *Skin*, loose, soft, elastic, free from scurf	3	.....
4. *Hair*, fine, soft	2	.....
5. *Face*, short, fine	2	.....
6. *Forehead*, broad	2	.....
7. *Eyes*, full, bright	1	.....
8. *Jaws*, wide, deep, and strong	1	.....
9. *Neck*, short, thick, curving smoothly into shoulders and brisket, throat clean; dewlap slight	4	.....
10. *Shoulders*, compact, snug, and smooth; top and points well covered; thickly and evenly fleshed	6	.....
11. *Fore legs*, short, straight, arm full; bone fine and clean	3	.....
12. *Brisket*, neat, firm, broad	2	.....
13. *Chest*, full, deep, wide; heart girth large, fore flanks deep and full	5	.....
14. *Barrel*, medium length, belly not conspicuously large	5	.....
15. *Crops*, full, thickly and evenly fleshed	5	.....
16. *Ribs*, long, closely set, well sprung, extending well back, thickly and evenly fleshed; back broad and straight	12	.....
17. *Loin*, broad, straight; thickly and evenly fleshed	10	.....
18. *Hips*, wide but not prominent, smoothly covered	4	.....
19. *Rump*, long, level, wide; tail head smooth; thickly and evenly fleshed	10	.....
20. *Pin bones*, far apart; not prominent	2	.....
21. *Thighs*, full, deep, fleshed well down to hocks	5	.....
22. *Twist*, deep, full	5	.....
23. *Hind legs*, short, straight, bone fine and clean	3	.....
24. *Hind flank*, full, low, and thick	3	.....
Total	100	.....

Animal ..... Date .....
Judge .....

[a] Used by department of animal husbandry, University of Missouri.

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